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# Technology in the Seventies : Symposium

The Science Reporter Forum of CSIR organized a two-day symposium on 'Technology in the Seventies' in New Delhi on 9 and 10 July 1970. Besides a session devoted to the crucial problem of 'Technological policy in the seventies', there were three sessions at which problems, policies and trends of development in three specified areas, viz. (1) Electronics and communication, (2) Chemicals and petrochemicals, and (3) Metallurgy and heavy engineering, came up for discussion. Several eminent men from government departments, research institutions, industry and the press participated in the deliberations of the symposium.

An important point on which the symposium focussed attention was the need for the formulation of a technological policy resolution. Urging for such a policy, Dr Atma Ram, Director General, Scientific & Industrial Research, said that the Science Policy Resolution, which was accepted by Government some years ago was not enough in view of the fact that translation of science into practice requires a sound technological policy. The technological policy, Dr Atma Ram suggested, should determine priorities in research, allocation of funds according to the priorities, and development of technologically competent manpower. The resolution must spell out in clear terms the course the country should adopt in the field of technology so that funds allocated for scientific research are utilized for the benefit of the common man. The Director General stressed that the improvement of the living standards of the common man through the application of science and technology should be the basis of the country's technological policy in the seventies.

The symposium brought to light the motivations and objectives for the formulation of a technological policy. These included: (1) Creation of necessary conditions to ensure highest priority to the utilization of indigenously developed technology in preference to others; (2) Import of technology only when such technology is either not available indigenously or where economic factors do not permit of the time involved in indigenous research being undertaken at that stage; in all such cases the technology imported must be a compatible technology; (3) Wherever it becomes a compatible technology, the R & D organizations in the country should initiate further research and development starting with this compatible technology.

Discussions at the various sessions devoted to specific areas dealt with the experiences of the past, the prospects for the future and the problems needing solution, and provided broad directions for the planning of R & D effort in these areas. In the field of electronics, integrated circuits were indicated as representing the most important line of development. Other prominent lines of development predicted are: radar systems for use in traffic control; use of satellites for relay and direct transmission of television programmes; increased use of lasers in holography; and increasing application of electronics in industrial process control systems. Time-sharing of computers among a large number of users was an exciting trend predicted. The special significance of electronics to India as a means of bridging the technology gap was generally recognized. It was brought out that compared to other technological disciplines, electronics provides high employment potential as well as a large turn-over for a given investment. The most important point stressed in the discussions at the session on chemicals and petrochemicals was that, in view of the unsatisfactory performance of most of the large industrial units in this field, it would be advisable to develop 'middle-scale' technologies suited to the indigenous economic climate, availability of raw materials, market fluctuation and demand for the product and availability of technical manpower.

In the field of metallurgy, the promising lines of development enumerated were: setting up of less number of blast furnaces with higher steel capacities; use of sinter to improve the blast furnace productivity; use of iron ore pellets as blast furnace feed; increased use of large sized LD oxygen converters in place of hearth furnaces; and use of continuous steelmaking processes based on counterflow of slag in open hearth plants. Emphasis was laid on the intensification of R & D effort towards development of nickel-free alloys, substitute alloys replacing non-ferrous metals not available in India, and increased industrial use of aluminium.

Under-utilization of capacity in the heavy engineering industry and shortage of skilled foremen and other first-line supervisors for the heavy engineering plants were identified as the major problems hampering the growth of this industry. A point was made that the idle engineering capacity could be fully utilized if there was a change-over from product classification to process classification of industrial capacity. To remedy the shortage of skilled foremen the introduction of a sandwich programme of technical education was suggested, under which students may work in factories while acquiring professional education.

The deliberations at the symposium were of immense value, as technological forecasting is increasingly recognized as an essential ingredient of all energetic R & D activities. This point was emphasized by Shri K. C. Pant, Minister

for Scientific & Industrial Research and Electronics, and Vice-President, CSIR, in his concluding address at the symposium. He pointed out that it was essential to know the course of technology in certain sectors of industry such as metallurgy, heavy engineering, electronics, petrochemicals and synthetic fibres. Technological forecasting should also include attempts to determine priorities in research and allocation of resources in order to achieve a given set of goals. The Minister emphasized the point that technological forecasting should become a part and parcel of our general planning processes.

## Council of Scientific & Industrial Research Annual Report: 1969

The annual report of the Council of Scientific & Industrial Research for the year 1969, 28th in the series, which has been published recently, reviews the progress of research under some selected basic and applied research projects. An attempt is made to bring out the impact of the results of applied projects leading to the substitution of materials scarce or in short supply; elimination of imported materials and products; and utilization of the processes developed by CSIR etablishments by industry and the benefits accruing therefrom. The 173-page (royal 8vo) report focusses attention on the important R & D activities of the Council through as many as 26 illustrations.

The report shows that the research programmes of CSIR are becoming more and more application-oriented to develop new industrial processes for the economic development of the country.

### R & D Activities

A brief account of select items of work of the CSIR laboratories and industrial research associations, culled from the report, is given in the following paragraphs under some broad fields of activity.

### Physics and electronics

A single mode helium-neon gas laser with Brewster's windows and external confocal mirrors was successfully developed by the National Physical Laboratory (NPL), New Delhi. The mirrors, coated with 15 alternate layers of ZnS and $MgF_2$, had a reflectance of over 99% at 6328A. The maximum life of unsealed tube was about 100 hr. A significant modification was the development of the laser with integral mirrors without Brewster's windows. Gas and solid state lasers are being increasingly used in research, communication and precision measurements. The estimated demand for lasers in the country is about a thousand pieces valued at over Rs 2 million in foreign exchange. An electrostatic photocopying machine for copying documents on ordinary paper by a dry process employing a re-usable photoconductive plate was developed by NPL. This machine is an extremely useful device for producing clean and dry documents and line drawings quickly and at a fraction of the cost of photocopies. Fabricated with indigenous components, the cost of the machine is estimated at Rs 25 000, whereas the imported machine costs between Rs 60 000 and Rs 1 00 000. Another notable achievement by NPL is the development of semi-conductor grade silicon used in transistors and rectifiers. The present estimate of the country's requirement of semiconductor grade silicon is about 2000 kg/annum, and at the current price of Rs 10 000/kg, the estimated foreign exchange savings when production of the material is established in the country would be about Rs 2 crores/annum. At the instance of the Posts & Telegraphs Department, the laboratory developed know-how for the production of professional ferrites which meet the stringent specifications and can replace the imported product.

A critical system used in the locomotives (2600 hp) manufactured by tihe Diesel Locomotive Works (DLW), Varanasi is the type E excitation control system for controlling the generator voltage and current. The electronic modules used in the control system are imported and cost more than Rs 30 000 per locomotive. At the instance of the Heavy Electricals (India) Ltd, Bhopal, who manufacture the electrical equipment for DLW, the Central Electronics Engineering Research Institute, Pilani developed two prototypes of transistorized excitation control system and tested on a locomotive up to a maximum service speed of 120 km/hr. One of the prototypes was commissioned on a locomotive for service trials.

### Chemical technology

The acetanilide plant of the Hindustan Organic Chemicals Ltd, Rasayani which is based on the know-how provided by the National Chemical Laboratory (NCL), Poona was commissioned. When in full production the plant will produce 2000 tonnes/annum of acetanilide valued at Rs 1.25 crores. Until now the country's requirements of acetanilide, the key starting material for sulpha drugs, was met by imports. Other processes and products developed by NCL, Poona are: (1) polyurethane coating suitable for leather, rubber, wood, glass and metal substrates using indigenous raw materials; (2) polyurethane resins for application on synthetic fabrics used in the fabrication of high altitude collapsible tents required by the army; (3) triphenyl phosphate used as plasticizer for

### CSIR : 1969 BASIC DATA

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| Establishments | 34 |
| Research Committees | 13 |
| Industrial Research Associations | 9 |
| Research Centres | 2 |
| Research Schemes | 627 |
| Emeritus Scientists | 17 |
| Retired Scientists | 58 |
| Pool Scientists | 355 |
| Research Fellowships | 2294 |
| Scientific & Technical Staff | 9127 |
| Administrative Staff | 2432 |
| Research Papers Published (Laboratories) | 933 |
| Patents Filed | 84 |
| Publications | 101 |
| Periodicals | 44 |
| Processes Leased to Industry | 101 |
| Processes Utilized by Industry | 37 |
| Total Processes in Production | 164 |
| Revised Budget for 1969-70 (Rs in lakhs): | |
| Capital | 614.155 |
| Recurring | 1395.446 |

cellulose mixed esters and cellulose based plastics; and (4) simazine, a herbicide used in controlling herbs associated with maize, wheat, sugarcane and other crops.

Investigations on the production of fat from sal (*Shorea robusta*) seed were completed by the Regional Research Laboratory (RRL), Hyderabad which undertook the project at the instance of a sponsor. The fat can be used as an extender for cocoa butter and in soap making. Plants for the production of (1) benzyl chloride (1 ton/day) by chlorination of toluene; (2) benzyl alcohol and benzyl acetate from benzyl chloride; and (3) benzotrichloride by chlorination of toluene were commissioned at Orgaroma India Pvt Ltd, Hyderabad on the basis of processes worked out by RRL, Hyderabad. These chemicals are widely used in perfumery and dye industries.

Activated carbon comparable to E Merck grade was prepared by RRL, Jorhat from Assam coal. The product is suitable for use in oil refining and in pharmaceutical industries.

At the instance of the rubber manufacturing and rubber reclaiming industries, the Indian Institute of Petroleum (IIP), Dehra Dun worked out process details for producing extender oils using feedstocks available from refineries. Extender oils are presently imported to the extent of 11 000 tons/annum. The institute also worked out process details for the prduction of microcrystalline waxes from indigenous crudes and bottom sediments from storage tanks. The high and low melting microcrystalline waxes presently imported, are widely used in pulp, paper, textile, electrical, leather, cosmetics and pharmaceutical industries.

Aluminium capacitors are required by the electronics and radio industry. These capacitors give large capacitance per unit volume and are cheap. A process for fabricating aluminium capacitors using etched aluminium foil was worked out by the Central Electrochemical Research Institute (CECRI), Karaikudi. A pilot plant for continuous etching and forming of aluminium foil is being set up by the institute. A pilot plant for the production of electrolytic manganese dioxide (25 kg/day) was set up by CECRI, Karaikudi. Electrolytic manganese dioxide is used as a depolarizer in high drain batteries and is presently imported.

**Drugs and pharmaceuticals**

A process for the manufacture of paracetamol from phenol (indigenously available) instead of *p*-aminophenol (imported) was developed by the Central Drug Research Institute (CDRI), Lucknow and handed over to industry. Paracetamol is used widely as an analgesic and as an intermediate in the preparation of amodiaquine, an antimalarial. Commercial processes for the preparation of the following drugs were standardized: (1) diphenylhydantoin sodium (used in the treatment of epilepsy); (2) *p*-phenylenediamine (hydrochloride is used as reagent for testing blood, amyl alcohol and milk); (3) lidocaine (local anaesthetic used in preference to procaine); and (4) choline chloride (used for treating cases of fatty infiltration of liver and early cirrhosis).

Investigations carried out at the Indian Institute of Experimental Medicine, Calcutta have shown that the antifungal antibiotic, versicolin (isolated from *Aspergillus versicolor*), is an effective and non-toxic agent for inhibiting the growth of *Trichophyton rubrum*, the casual agent for 90% of skin infections in eastern India.

A process for the isolation of xanthotoxin, an anti-leucoderma and dermal photosensitizing agent, from the roots of *Heracleum candicans* was standardized by the Regional Research Laboratory (RRL), Jammu.

Ichthammol, a sulphonated product obtained from bituminous shales, is used in the treatment of skin diseases and is presently imported to the extent of 50 tons/annum, valued at about Rs 2.40 lakhs. A process for the production of the drug utilizing certain high-sulphur crudes, being processed in the refineries, was worked out by IIP, Dehra Dun.

Clinical trials of ascorbic acid therapy of industrial workers suffering from benzanthrone dye toxicity were started by the Industrial Toxicology Research Centre, Lucknow in collaboration with a dyestuffs industry in Bombay.

**Essential oils, perfumery chemicals and other plant products**

Investigations on the culture of *Eucalyptus citriodora* for essential oil and production of the perfumery chemicals, citronellol and citronellal, were carried out at the Regional Research Laboratory (RRL), Jammu. The laboratory developed an economic method for the production of pure citronellal and high grade citronellol from the essential oil. The total imports of citronellol, citronellal and the oils containing these chemicals at present amount to Rs 15 lakhs/annum.

A promising cultivar of dill (*Anethum graveolens*), with an umbel double the size of the normal European dill, was evolved by the Central Indian Medicinal Plants Organization, Lucknow at Haldwani from among commercial cultivars from 17 countries. The cultivar yields large amounts of seed and the oil obtained is of perfumery grade unlike the oils of Indian origin. About 600 tons of dill, valued at about Rs 70 lakhs, are exported annually.

Biosynthesis of some gibberellins (GA3, GA1 and GA7), the well-known growth-promoting substances, was achieved by the National Botanic Gardens (NBG), Lucknow by culturing the fungus *Gibberella fujikuroi* in synthetic media. Extensively used for boosting the production of agro-industrial crops such as grape vine, gibberellins are imported at a prohibitive cost of Rs 70-80/g. Another significant achievement of NBG was the standardization of synthetic media for the culture and propagation of excized tissues of *Rauvolfia serpentina*. Reserpine and allied alkaloids were obtained from the roots of *R. serpentina* propagated in the laboratory by tissue culture techniques.

**Glass, ceramics, leather and other technologies**

At the instance of the Solid State Physics Laboratory, New Delhi, the Central Glass & Ceramic Research Institute (CGCRI), Calcutta developed a process for manufacturing high-alumina seals and spacers and metallizing them. These are required for housing microwave crystals for the development of electron tubes, diodes and triodes, which are used in electronic equipment

operating at ultra-high frequency. The high-alumina ceramics are superior to glass ceramics.

A process for manufacturing ultra-low density mica bricks utilizing waste mica abundantly available in the country was developed by CGCRI. The bricks are suitable for thermal insulation, particularly as substitutes for imported diatomite bricks. The demand for such bricks, estimated at 15-20 lakhs/annum, is presently met by imports. Another product developed by CGCRI, is the fire retardant paint using waste mica powder as an essential ingredient. The paint is suitable for application on wood, canvas, metals and hardboard.

A new series of acrylic polymer emulsions incorporating various amounts of shellac resin for leather and shoe finishing were developed by the Central Leather Research Institute (CLRI), Madras. The product (Rs 10/kg) possesses the advantages of both acrylics and lac and has given encouraging results in trials. The institute standardized a process for the manufacture of zirconium tanning salt and worked out a process for making zirconium tanned skins. Zirconium tannage yields rich shade in finished leathers which have high export market. In view of the extensive deposits of zircon sand in India, there is good scope for earning considerable foreign exchange through the utilization of the indigenous raw material.

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar undertook the development of desalination plants suitable for sea-going vessels, and supplied the design for a 30-tonne/day capacity desalination plant for use on the survey ship INS Darshak. The institute also fabricated in collaboration with the Industrial and Agricultural Engineering Co. an electrodialysis unit having a capacity of 3000 gal/day. The plant was successfully operated for several months at the premises of a factory at Morvi. The design of prototype electrodialysis unit to be mounted on army vehicles was supplied to the Research & Development (Engineers) of the Defence Organizations.

**Fuels, metallurgy and mining**

A vapour phase catalytic hydrogenation pilot plant (output, 500 litres/day) was commissioned at the Central Fuel Research Institute (CFRI), Dhanbad. An integral part of the institute's coal-to-oil project, the plant will produce liquid fuels, especially middle distillates, and employs the catalyst developed by CFRI for hydrogenation of coal. The institute completed a preliminary feasibility study on the conversion of Upper Assam coal to oil by hydrogenation. The study has shown that a plant of 1 lakh barrels/day capacity would be an economically viable unit, but considering the practical limitations, coal refining can be integrated with oil refining having individual capacities of 60 000 barrels/day. Commercial utilization of the process would lead to the elimination of imports of crude oil. At the instance of the Madhya Pradesh Industrial Development Corporation, CFRI completed a feasibility study for the utilization of Kutkona coal from Sohagpur coalfield.

At the instance of the Uranium Corporation of India, Jaduguda, the National Metallurgical Laboratory (NML), Jamshedpur carried out investigations on the recovery of molybdenum, copper and nickel minerals (which are in short supply) from uranium ore samples containing 0.24% copper, 0.29% nickel and 0.30% molybdenum and developed a process flowsheet for the recovery of these scarce minerals from run-of-mine uranium ore prior to uranium extraction. Pilot plant studies are being continued for setting up a mineral byproduct recovery plant for treating 1000 tonnes of run-of-mine uranium ore per day at Jaduguda. The laboratory also carried out, at the instance of the Hindustan Zinc Ltd, Udaipur, batch and pilot beneficiation studies on low grade rock phosphate samples from Rajasthan with a view to producing phosphate concentrate suitable for the manufacture of superphosphate. The studies have shown that starting from samples containing 28% $P_2O_5$, a concentrate containing 36% $P_2O_5$ with recoveries of 75% $P_2O_5$ could produced. These results hold out prospects of establishing phosphatic fertilizer industry in the state.

Investigations carried out by the Central Mining Research Station, Dhanbad have shown that coir matting could be used for sand stowing; the former is many times stronger than the conventional material such as brattice cloth, hessian cloth and bamboo matting.

**Food & fruit technology**

For preventing fungus infection on the cut surfaces of banana hands and bunches during transportation and storage, the Central Food Technological Research Institute (CFTRI), Mysore developed an antifungal paste. Superior to imported formulations, the paste applied to cut ends of green bananas, controls decay for 18-21 days during storage at low temperatures. A process for producing tamarind juice concentrate was also worked out by CFTRI. The concentrate possesses good flavour, keeping quality, and is free from insect infestation unlike the pulp. A concentrator (capacity, 1000 kg) for concentrating the juice was designed and the details of fabrication were released to a firm which has taken up the process. The institute evaluated the suitability of different kinds of tinplates manufactured in the country, for canning fruits and vegetables. It has been found that three types of Rourkela tinplates with 0.02, 0.025 and 0.03% phosphorus contents are suitable for canning mildly corrosive products like green peas, cabbage, potato and tomato and orange juices. This finding is of considerable interest to the canning industry which imports tinplates.

**Engineering**

The Central Building Research Institute (CBRI), Roorkee completed the foundation of a 15-storeyed electronics and telecommunication tower at the University of Roorkee with multi-under-reamed pile carrying a safe load of 73 tonnes on each pile. This mode of construction effects considerable savings in construction costs as compared to conventional raft foundation. High slag masonry cement having very high compressive strength was developed by CBRI. Mortar prepared using this cement gave very satisfactory results. A simple and flexible system for housing, which will contribute to speed and economy in construction, has been taken up by CBRI to meet the growing shortage of housing and to lower the building costs. A planning system based on collinear arrangement of square units was evolved

for the planning of system-built housing for low and middle income groups.

Field investigations carried out by the Structural Engineering Research Centre, Roorkee have shown the utility of open web steel structures for covering large areas economically. This technique of construction, which is not yet widely practised in India, is likely to result in considerable savings in steel. The centre has taken up the preparation of standard designs of transmission line towers for various wind pressures and temperature zones in the country.

At the instance of the Central Public Works Department, the Central Road Research Institute, New Delhi carried out investigations to assess the requirements for strengthening and extending the pavement of the main runway at Santa Cruz airport at Bombay in view of the anticipated operation of Jumbo jets in early 1970 and supersonic aircrafts later at this airport. Recommendations for the design and construction of pavements in the extension portion and of overlays for strengthening the existing pavement in different sections were made.

A 10-ton electrohydraulic programme load fatigue testing machine was designed and developed by the National Aeronautical Laboratory (NAL), Bangalore. This machine together with the other types of fatigue testing machines such as the axial load sub-resonant fatigue testing machine and the 300 in lb rotating cantilever fatigue testing machine, earlier developed by NAL, help save considerable amount of foreign exchange in the import of such machines. These machines are 50% cheaper than the imported counterparts. The laboratory also fabricated an advanced model of a filament winding machine capable of fabricating fibreglass reinforced plastic (FRP) cylinders up to 8 ft long and 2 ft diam. FRP materials have wide applications in aeronautic and aerospace industry, chemical and electrical industries due to their high strength-to-weight ratio, chemical resistance and dielectric properties.

The Central Mechanical Engineering Research Institute (CMERI), Durgapur designed and developed the prototype of the waste-heat cooler (capacity, 0.5 ton) using indigenous materials. A pulse engine was developed by CMERI, Durgapur using entirely indigenous materials. The engine is very compact (1/100th of the conventional system) and is available in two capacities—10 000 and 50 000 kcal/hr and 1, 2 and 6 litres of gasoline respectively. The engine has been used for powering a low volume insecticide sprayer.

A batch-type accelerated freeze drying unit was designed and fabricated by the Regional Research Laboratory, Bhubaneswar using entirely indigenous refrigeration components and accessories. The unit which has undergone successful trials is ideal for use in research and industrial establishments and hospitals.

The Central Public Health Engineering Research Institute (CPHERI), Nagpur developed disinfection tablets for disinfecting surface waters. The advantage of the tablets, known as double action tablets, over the commercially available ones is that in addition to disinfecting the waters they remove suspended matter unlike the ones available in the market. A 1.0 g tablet is sufficient to treat about 2 gal of water having a turbidity up to 500 ppm. A new pilot plant for defluoridation of water was set up at Nalgonda (A.P.) to treat 20 000 gal of water per day. Defluoridation of water is carried out using the medium Defluoron-2, a synthetic carbonaceous sulphonated material in granular form, developed by CPHERI.

### Geophysics and oceanography

The National Geophysical Research Institute, Hyderabad successfully carried out its first sea-borne magnetic survey off Bombay coast using its method and instrumentation to study the continent-ocean boundaries and geologic structures on the sea floor. The NW-SE trend in the isogamma map prepared supports the northward continuation of Chagos Island under water up to Kori High forming an arcuate ridge feature in the Arabian Sea. The structures may be favourable for oil accumulation.

The National Institute of Oceanography (NIO), Goa is carrying out studies on the silting processes taking place at Cochin and Marmagao harbours and Mopla Bay (Cannanore) with a view to evolving suitable measures for proper maintenance and development of harbours. Another important project under investigation by NIO is the distribution of oxygen and nutrients in the Indian Ocean. Charts showing the depths of occurrence of oxygen maxima and minima in the upper 500 m in the north-west Indian Ocean were prepared. The charts provide valuable information relating to the water movements and circulation.

### Instruments and devices

The National Chemical Laboratory, Poona fabricated a potentiometric strip chart recorder using mostly indigenous components. The unit can be used in conjunction with vapour phase chromatograph, nuclear magnetic resonance, ultra-violet and differential thermal analysis units. The design and fabrication details were released to Associated Instrument Manufacturers (India) Pvt. Ltd, New Delhi. The laboratory also developed cadmium sulphide photoconductive cells based on photosensitive cadmium sulphide crystals which maintain their properties for a long time unlike evaporated cadmium sulphide devices which are sensitive to moisture. The cells are used in light detectors and industrial safety instruments. The process was released to Gera Engineering Co., Poona.

The Central Scientific Instruments Organization, Chandigarh, fabricated (i) E. C. G. simulator for carrying out development and testing of electro-cardiograph machine, (ii) single-channel analyser with pulse amplifier, and (iii) digital voltmeters.

### Dissemination of scientific information

The Publications & Information Directorate, New Delhi brought out Volume VIII of the Wealth of India: Raw Materials covering the alphabets Ph-Q-Re. This volume includes 156 articles on plants, 2 on animals and animal products and 5 on minerals. Other books brought out by the directorate during the year under review are : Evolution of Life (M. S. Randhawa, Jagjit Singh, A. K. Dey and Vishnu Mittre) and Indian Thysanoptera (T. N. Ananthakrishnan), the first in the Zoological Monographs series.

The Indian National Scientific Documentation Centre, New Delhi

compiled and published 'The Directory of Scientific Research Institutions in India: 1969', which contains information on over 900 scientific institutions in regard to history, functions, fields of research, achievements, special research facilities, budget, staff and library holdings.

The Central Scientific Instruments Organization, Chandigarh compiled and published 'Directory of Scientific Instruments and Components Manufactured in India'.

### INDUSTRIAL RESEARCH ASSOCIATIONS

The Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad developed a fibre length tester which can give complete analysis of a cotton sample in 15 min. A semi-automatic sampler was also designed to prepare aligned fibre tufts from the cotton sample. The advantages of the fibre length tester with auto-sampler, developed by ATIRA, are that it is less time-consuming, more reliable and cheaper than the conventional instruments which are partly imported. Another instrument developed by ATIRA is a photoelectric device for measuring yarn evenness, which also characterizes the hairiness of yarns.

Wear trials on the polyester and cotton blends and all-cotton fabrics processed for durable press by the method developed by the Bombay Textile Research Association (BTRA), Bombay have shown that 67% polyester and 33% cotton fabrics show good performance up to 20 wear and laundering cycles. The process developed by BTRA is based on the chemical modification of cotton, whereas the conventional durable press process employs resin finishing.

A pilot scale laminating machine for laminating different types of fabrics with polyurethane foam for various end-uses was designed and fabricated by the Silk and Art Silk Mills' Research Association (Sasmira), Bombay. A paraffin-ester gum formulation for use in heat transfer labels was developed by Sasmira. Labels transferred using the formulation are permanent and bright. A laboratory scale label printing machine and an engraved roller with designs were designed and fabricated.

Laboratory and bulk trials of the anti-shrink process, developed by the Wool Research Association, Bombay, were conducted on tops and yarns in member millls. The process is ready for commercial utilization.

Field trials on combating infestation of a variety of pests on tea, carried out by the Tea Research Association, Toklai, have shown that a mixture of acaricides is not only as effective as individual acaricides but the cost of pest control in tea can be reduced to one-third. Field studies on pruning of tea have revealed that the best quality tea can be produced only from pruned and deep skiffed teas.

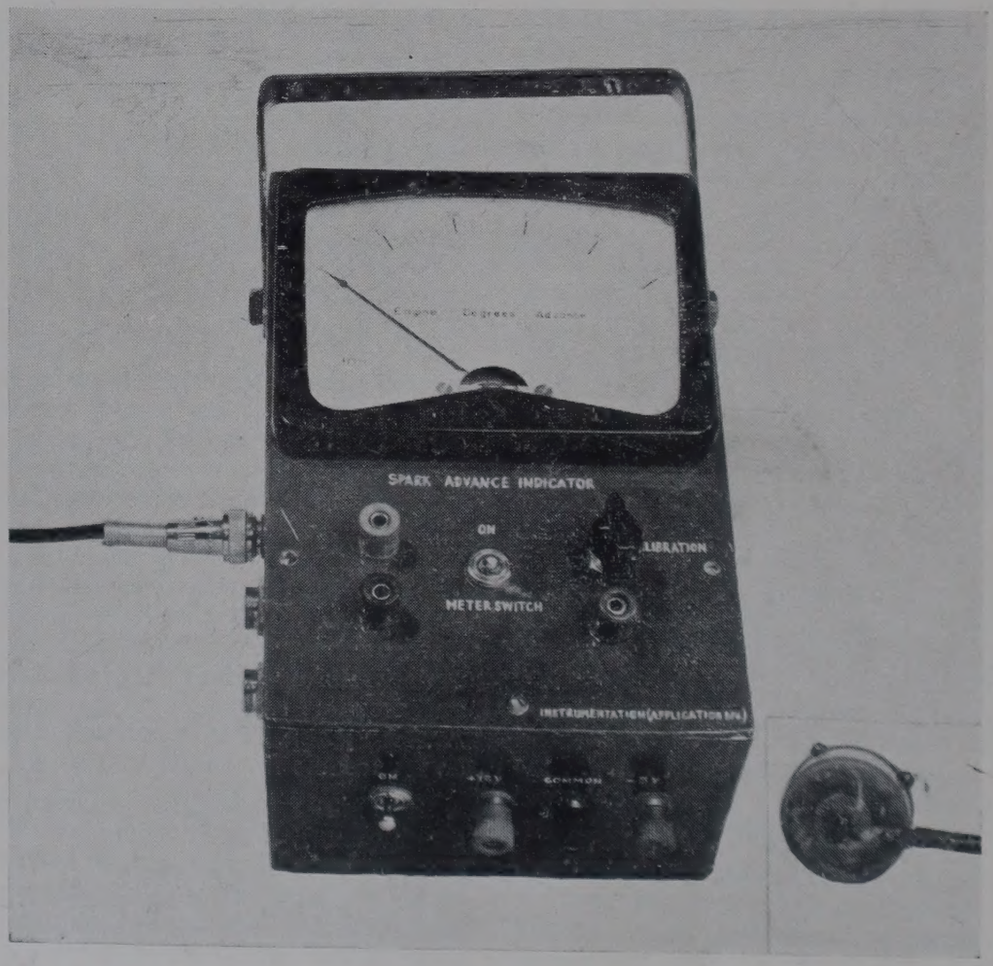
The Indian Jute Industries Research Association, Calcutta developed a chemical-cum-mechanical technique for upgrading poor quality jute fabrics for utilization in better quality products such as carpet backing. The process has been utilized by jute industry for large scale manufacture of conventional jute goods.

The Plywood Industries Research Association, Bangalore developed a process for producing particle boards with satisfactory strength properties using coconut coir pith wastes.

## IIP Fabricates Transistorized Spark Advance Indicator

One of the parameters, often required to be measured and set in a spark ignition engine, is spark advance. Instruments used for measuring spark advance are imported. A transistorized spark advance indicator has been designed and fabricated by the Indian Institute of Petroleum (IIP), Dehra Dun using entirely indigenous components. The fully transistorized circuit makes the instrument compact and portable.

The main parts of the instrument are two amplifiers, two monostable multivibrators and a bi-stable multivibrator. One of the two signals, required for measuring spark




Transistorized spark erosion indicator fabricated by IIP

advance, is obtained by using electromagnetic transducer and a pointed iron stud fixed at a definite point on the rotating part of the engine; the other signal is derived from ignition primary make-break circuit. Both the signals are transformed into two fast square pulses with the help of amplifiers and monostable multivibrators and then coupled to the two input points of bi-stable multivibrator. The output from the bi-stable multivibrator is in the form of square wave. The duration of the square pulse is directly proportional to the time delay between the input signals appearing at the inputs.

By fixing the iron stud in such a way that the signal from the electromagnetic transducer corresponds to the piston at top dead centre, a square pulse is obtained from any one of the two collectors of bi-stable multivibrator, whose duration corresponds to spark advance. The square pulse is then integrated suitably to give spark advance.

The instrument operates on a power supply of 12 V, which is taken from the same battery used for the engine. When tested for long duration performance at various ambient temperatures ranging between 5° and 50°C, it was found to give very satisfactory performance. The total cost of fabricating the instrument in the laboratory is about Rs 450.

## Indigenous Lepidolite as Glass and Ceramic Raw Material

Investigations carried out by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta have indicated that indigenous lepidolite (lithium mica) rock associated with felspar and quartz could be used as a raw material for making glass and glass-ceramic products. Good glasses melting at temperatures below 1350°C could be obtained by addition of titania, calcia and magnesia to the lepidolite composition. The coefficient of thermal expansion of the glasses ranged from 67 to $98 \times 10^{-7}$ °C, annealing temperature from 500°C to 570°C, melting point from 600°C to 660°C, specific gravity from 2·7 to 2·9 and modulus of rupture from 9 to $11 \times 10^3$ psi. The differential thermal analysis of the glasses gave endotherms between 625°C and 675°C and exotherms between 690°C and 940°C.

Glass-ceramics characterized by high breaking strength (about 4 times that of the glass) could be obtained by nucleation of the glasses followed by heat treatment. Volume crystallization was obtained with titania as nucleant when the magnesia content was not less than 4% by weight. The glass of composition $SiO_2$ 33, $Al_2O_3$ 16, CaO 13, MgO 13, $Li_2O$ 2, $K_2O$ 6, $Na_2O$ 1, F 3, $TiO_2$ 13 wt % heat-treated at 900°C for 16 hr yielded glass-ceramics of an agreeable light pink colour having breaking strength of $36 \times 10^3$ psi and coefficient of thermal expansion of $90 \times 10^{-7}$ per °C.

The glass-ceramics were found to be suitable for making high strength pressed or blownware, formed by the conventional glass forming techniques. The method of production is simpler compared to the various operations involved in the production of conventional ceramics. The composition is melted and formed into suitable shapes and subsequently heat-treated to produce the glass-ceramics. The advantage of the process is that the products have a natural gloss and require no separate glazing operation.

Investigations at CGCRI have also established that lepidolite has pronounced fluxing action and could be used as a substitute for felspar and preferably along with a limited amount of talc (not exceeding 10%) to produce a semi-vitreous ceramic body having high mechanical strength and wide maturing range at a temperature as low as cone 2 (1162°C). Further work is in progress for developing low-expansion thermal shock resistant ceramic bodies based on lepidolite as the major ingredient.

## True Ultimate Strength of Concrete under Uniaxial and Multiaxial Stress Systems

The true ultimate strength of concrete under uniaxial compression is 70-90% of the ultimate strength as determined in short-term tests. In practice, a concrete structure is subjected not only to uniaxial compression but to combined stresses which are sustained for considerably long periods. A knowledge of the strength of concrete under sustained, multiaxial stress systems is necessary for providing for the necessary factor of safety at the time of initial design. The true ultimate strength of concrete subjected to uniaxial tension, biaxial compression or triaxial compression has been estimated by the Cement Research Institute of India, New Delhi using the log stress versus log strain plots and the rate of strain versus stress plots of the stress-strain curves available in literature. The results, published in the institute's Research Bulletin RB-1-69, point to the conclusion that the true ultimate strength of concrete is 70-90% of the ultimate strength in short-term tests both under uniaxial and multiaxial stresses. These results would be useful in determining the real factor of safety of a structure subjected to sustained loading or in specifying suitable safe working stresses for a given factor of safety while designing concrete structures subjected to sustained loading. The bulletin also contains the results of tests on concrete cubes under uniaxial compression.

## Galactomannan of *Cassia absus* Seed

Chemical investigation of *Cassia absus* (Chaksu) seed galactomannan has been carried out by Shri V. P. Kapoor, research scholar, working under the guidance of Dr S. Mukherjee of the National Sugar Institute, Kanpur.

A galactomannan composed of D-galactose (1 mole) and D-mannose (3 moles) was isolated from the seed of *C. absus*. Methylation and hydrolysis of the galactomannan produced four methylated sugars. Of these, 2,3,4,6-tetra-O-methyl-D-galactose, 2,3,6-tri-O-methyl-D-mannose and 2,3-di-O-methyl-D-mannose have generally been reported in all seed galactomannans, but the presence, of 4, 6-di-O-methyl-D-mannose in hydrolysate of methylated seed galactomannan has not been reported so far.

A new solvent composition, butanone-ethyl acetate-water-ammonia (80:20:8:1; upper phase) has been developed for the separation of methylated sugars, especially of lower $R_f$ values.

Three disaccharides and two trisaccharides were isolated from the galactomannan employing an improved method of controlled acid hydrolysis. One of the disaccharides was found to be 2-O-α-D-galactopyranosyl-D-mannose. A degraded galactomannan of 16 hexose units has also been isolated during controlled acid hydrolysis.

On the basis of the studies, a structure for the galactomannan has been proposed, in which mannose units form the main chain and the galactose units form the branches, the former being attached mostly through 1→4 linkage (*c* 85%) and rest, which is nearly half of the branch points, through 1→3; the branches of single galactose units are attached through 1→6 (*c* 50%) and the rest through 1→2. It is thus seen that *C. absus* seed galactomannan is essentially similar to other seed galactomannans, the major difference being the attachment of half of the galactose side units to C-2 of the hexose unit of the main chain. In this respect it bears similarity to galactomannans isolated from microorganisms.

Shri V. P. Kapoor (presently at the National Botanic Gardens, Lucknow) was awarded the Ph.D. degree by the Agra University (1970) for his thesis titled 'Chemical investigation on the structure of *Cassia absus* (Chaksu) seed polysaccharide and other seed polysaccharides'.

### PATENTS FILED

126663: Improvements in or relating to lacquers for corrosion prevention, K. S. Rajagopalan & M. Sundaram—CECRI, Karaikudi.

126677: Improvements in or relating to the electrolytic reduction of nitrobenzene to *p*-aminophenol, H. V. K. Udupa, G. S. Subramanian, K. S. Udupa & T. D. Balakrishnan—CECRI, Karaikudi.

126708: Improvement in or relating to the design of a sensitive heat flowmeter, K. N. Agarwal, V. V. Verma & K. R. Rao—CBRI, Roorkee.

126770: A process for the recovery of silver and gelatin from the waste, processed and/or unexposed photographic films, plates, papers, cine films and X-ray films or plates, S. P. Srivastava, (Mrs) S. Laxmi, P. V. Krishna & M. S. Iyengar—RRL, Jorhat.

126988: A process for the recovery of silver and cellulosic bases from waste films, M.S. Iyengar, J. L. Ghose, R. K. Chakrabarti & R. Haque—RRL, Jorhat.

127007: A new material for the production of grease-proof paper and glassine paper for filing, P. P. Baruah, B. P. Chaliha, S. B. Lodh & M. S. Iyengar—RRL, Jorhat.

127059: Improvements in or relating to the electrolytic reduction of nitroguanidine to aminoguanidine, H. V. K. Udupa, G. S. Subramanian, K. S. Udupa & T. D. Balakrishnan—CECRI, Karaikudi.

127151: Improvements in or relating to the preparation of sintered photoconductive cadmium selenide cells, C. V. Suryanarayana, N. Rangarajan, K. N. Rao & (Mrs) M. J. Chockalingam—CECRI, Karaikudi.

127173: A process for the production of activated carbon from low rank caking coals, M. S. Iyengar, M. Dutta, R. K. Chakraborti & R. Haque—RRL, Jorhat.

127174: A process for the recovery of zinc and carbon electrode from waste dry cells, M. S. Iyengar, J. L. Ghose, R. K. Chakrabarti & R. Haque—RRL, Jorhat.

127236: A process for the production of a fungal acid protease for use as a bating agent in leather manufacture, A. Thangamani, R. K. Ghosh & P. K. Goswami—IIEM, Calcutta.

### PATENTS SEALED

112577: Improvements in or relating to impregnation of braided linen threads with conducting carbon, C. V. Suryanarayana, N. Rangarajan, K. N. Rao & M. J. Mangalam—CECRI, Karaikudi.

114419: A process for the synthesis of epoxidized derivatives of acetylated pentaerythritol diricinoleates as plasticizers for polyvinyl chloride resins, R. K. Bhatnagar & A. K. Jain—SRIFIR, Delhi.

114499: Production of refined pyrethrum extract of aerosol grade, S. Prasad & (Kum.) R. Jamwal—RRL, Jammu.

115204: Improvements in or relating to electrolyte for tantalum electrolytic capacitors, B. A. Shenoi, K. R. Narasimhan, V. Lakshminarasimhan, A. Anantharaman & D. Kanagaraj—CECRI, Karaikudi.

115207: A flushing cistern, P. B. Rao & I. Singh—CBRI, Roorkee.

## Symposium on Molecular Mechanism of Drug Action

A symposium on 'Molecular mechanisms of drug action' will be held at the Central Drug Research Institute (CDRI), Lucknow on 10 and 11 Dec. 1970 under the joint auspices of CDRI, the Society of Biological Chemists (India) and the Indian Pharmacological Society. The symposium will highlight current knowledge concerning the molecular mechanisms of drug action and results of investigations pertaining to the following aspects of drug action: (1) Pharmacokinetics of drug action: interaction of drugs and macromolecules; (2) Bioreceptors of drugs, membrane transport of drug; enzymes as models of drug receptors; (3) Drugs acting on genetic expression; and (4) Drug detoxication mechanisms; microsomal induction of enzymes by drugs; biotransformation of drug intermediates and precursors.

The scope of the symposium has been kept broad-based to enable the participation of scientists belonging to different disciplines of biomedical research but engaged in studies in the borderline problem of the mechanism of drug action. The symposium will be divided into four sessions and each session will be initiated by an invited speaker who will present a working paper of 50-60 minutes' duration. The rest of the sessions will be utilized for presentation of short research papers of 15 minutes' duration from participants on any one of the above topics and discussion of the results and views presented.

Scientists wishing to present their work at the symposium may send a 200-word abstract of their papers so as to reach Dr C. R. Krishna Murti, Scientist-in-charge, Division of Biochemistry, CDRI, Lucknow not later than 30 September 1970.

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